Trend Study 16C-31-04

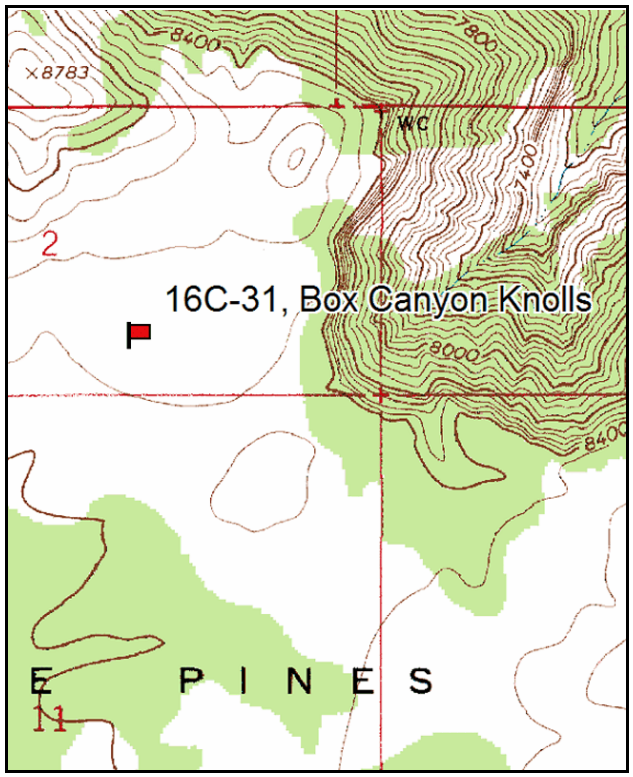
Study site name: Box Canyon Knolls . Vegetation type: Black Sagebrush .

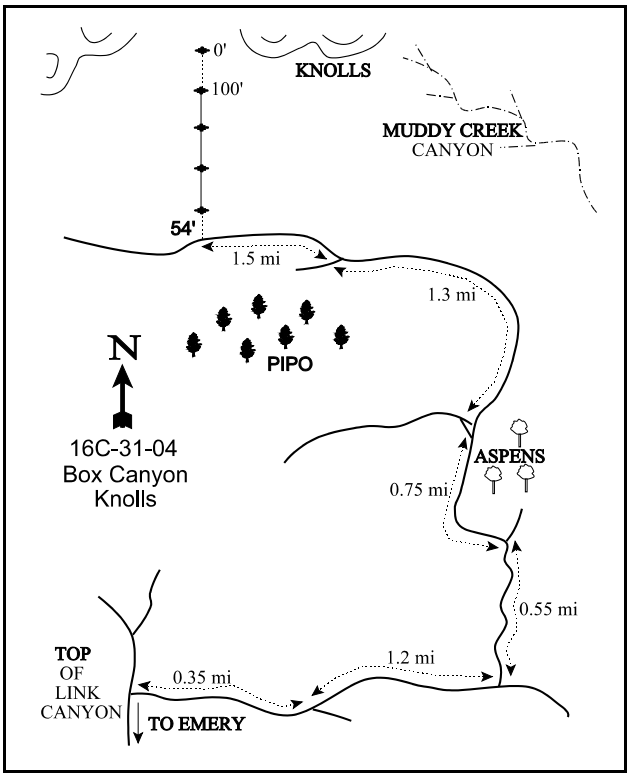
Compass bearing: frequency baseline 180 degrees magnetic.

Frequency belt placement: line 1 (11 & 95ft), line 2 (34ft), line 3 (59ft), line 4 (71ft).

LOCATION DESCRIPTION

From Center Street in the town of Emery, continue south on Highway 10 for 1.2 miles. Turn right onto a dirt road and go 0.6 miles. Turn left and travel up Link Canyon 7 miles (4WD road) to the top. Turn right at the fork and proceed 0.35 miles. Bear left and continue 1.2 miles. Turn left off the jeep trail and go 0.55 miles to a faint fork. Bear left onto F.S. Road #28 and go 0.75 miles to a junction. Bear right and continue northwest 1.3 miles to another fork. Stay right on F.S. #278. Travel 1.5 miles and stop just past a lone limber pine. In the sage flat on the right side of the road, the study is marked by short fenceposts. The 400-foot baseline stake is 54 feet north of the road. The 0-foot baseline stake is 400 feet further north, and is marked by browse tag #9028.





Map Name: Flagstaff Peak

Diagrammatic Sketch

Township 21S , Range 5E , Section 2

GPS: NAD 27, UTM 12S 4318002 N, 472029 E

DISCUSSION

Box Canyon Knolls - Trend Study No. 16C-31

The Box Canyon Knolls site is located on the south side of the steep Muddy Creek canyon. This remote area is used by elk in the winter. The study site is located in the open black sagebrush/grass type that covers most the flats. Elevation is 8,500 feet. The slope on the flat is very gentle with a southern aspect. The area is managed by the Forest Service, usually as an early unit in the summer rest-rotation system on the Emery cattle allotment. Abundant elk sign was encountered in 1994 and 1999. Pellet group data from 1999 estimate 5 deer, 108 elk and 9 cow days use/acre (12 ddu/ha, 267 edu/ha, and 22 cdu/ha). Pellet group data from 2004 estimate 87 elk and 25 cow days use/acre (215 edu/ha and 61 cud/ha). Most of the elk pellet groups are from spring and early summer. Cattle pats were from this season and a few appear to be from last season.

Soil on the site is moderately shallow with an effective rooting depth of almost 14 inches. Texture is a clay loam with a neutral pH (6.8). There is very little rock in the profile or on the surface. The soil is very dense with a compacted horizon which varies in depth from 8 to 12 inches. This moderately shallow soil is what identifies this as a black sagebrush site. The 1% slope precludes most soil movement and erosion is minimal, although bare spots are frequent. Some soil pedestaling is evident around shrubs and grasses. The surface of the clay loam soil shows expansion and/or contraction cracking which would indicate the presence of shrink/swell clays. Soil parent material appears to be limestone.

The dominant key browse species is a low-growing dense population of black sagebrush. Black sagebrush densities have decreased dramatically since 1999, mostly likely due to drought conditions. In 1999, black sagebrush was estimated at 12,680 plants/acre and in 2004 it was estimated at 3,220. The majority of the plants have light to moderate hedging. The age class structure indicates a declining population with poor young recruitment. The average recruitment for 1988 - 1999 was 35%, now it is at only 1%. The ratio of dead to live plants is only 1:1.75. One dead for almost every three plants. A small population of stunted mountain big sagebrush also occurs on the site, densities have decreased from 1,060 plants/acre in 1999 to 140 plans/acre in 2004. These shrubs show light to moderate use and dead plants have about 1:2.4 ratio. One dead for about every three plants.

Low rabbitbrush is extremely abundant on the site. These shrubs are small, measuring only 6 x 10 inches and have an estimated population density of 22,420 plants/acre in 1994, 19,220 in 1999, and decreased to 6,300 in 2004. They are lightly hedged, in good vigor, and have low decadence. Other species on the site include small numbers of Utah serviceberry, fringed sagebrush, dwarf rabbitbrush, rubber rabbitbrush, broom snakeweed, and gray horsebrush.

Grasses have decreased significantly on the site. Pinewoods needlegrass was the most dominant species providing 72% of the grass cover in 1994, 41% in 1999, and is no longer dominate at 5% in 2004. Mutton bluegrass is dominate on the site followed by slender wheatgrass and western wheatgrass. All grasses combined provided 14% cover in 1994, 11% in 1999, and 6% in 2004. Forbs are diverse and have increased from 2% cover in 1994, 3% in 1999, to 7% in 2004. Increase in forbs were largely due to an increase in annual forbs and tend to be low growing species.

1994 TREND ASSESSMENT

Trend for soil is slightly up due mostly to a decrease in relative percent bare ground from 54% to 35%. Litter cover has increased slightly and provides well dispersed protective cover. The key browse on this site is black sagebrush. The mature plants in the population have increased while the number of decadent plants have decreased. There are many young plants in the population but few seedlings. Trend for browse is slightly up. Sum of nested frequency of grasses have increased since 1988, while those of forbs declined. Sum of nested

frequency for perennial grasses and forbs combined have remained similar indicating a stable herbaceous understory trend. The Desirable Components Index (see methods) rated this site as good with a score of 72 due to fair shrub cover, low decadence, many young shrubs, and good grass and forb cover.

TREND ASSESSMENT
soil - slightly up (4)
browse - up slightly (4)
herbaceous understory - stable (3)
winter range condition (DC Index) - 72 (good) Mountain big sagebrush type

1999 TREND ASSESSMENT

Trend for soil is stable. Percent cover of litter has declined but cover of bare ground has remained fairly stable. There is some soil pedestaling apparent around plants but erosion is minimal due to the level terrain. Trend for browse is stable. Density of the key species, black sagebrush, has increased slightly and there are abundant seedlings and young. Utilization is slightly higher, but still mostly light use. Vigor is normal on most plants. Percent decadency has increased slightly but it is still low at 14%. The small stand of stunted mountain big sagebrush has increased slightly in density. It displays moderate to heavy use, good vigor and increased decadence since 1994. Rabbitbrush is still the most abundant numerous shrub on the site. This increaser, has declined steadily in density since 1988 from 32,599 plants/acre to 19,220 by 1999. The population is mostly mature with a moderate amount of young plants sampled. Trend for the herbaceous understory is stable, even though sum of nested frequency for perennial grasses and forbs has declined slightly. It is not enough change to show a downward trend. Both slender wheatgrass and pinewoods needlegrass have declined, but was compensated by increases in other grasses. The Desirable Components Index rated this site as good with a score of 68 due to fair shrub cover, increase in decadence, several young shrubs, and a decrease in grass and forb cover.

TREND ASSESSMENT
soil - stable (3)
browse - stable (3)
herbaceous understory - stable (3)
winter range condition (DC Index) - 68 (good) Mountain big sagebrush type

2004 TREND ASSESSMENT

Trend for soil is down slightly. Percent cover of litter and vegetation have declined and cover of bare ground has increased. Erosion is minimal mostly due to flat characteristics of the site. Trend for key browse is down. Density of black sagebrush has decreased, while dead plants increased from 1,220 plants per acre in 1999 to 4,320 in 2004. The small stand of stunted mountain big sagebrush decreased from 1,060 plants/acre in 1999 to 100 plants/acre in 2004. Recruitment of young for both species is minimal while hedging continues to be light. Rabbitbrush is still the most abundant shrub on the site, but it has also decreased. Density of rabbitbrush decreased from 22,420 plants/acre in 1994, 19,220 in 1999, to 6,300 in 2004. Rabbitbrush seedlings were abundant this year estimated at 4,740 seedlings/acre. Trend for herbaceous understory is down because of the magnitude of decrease for both perennial grasses and forbs. Grasses have steadily decreased in sum of nested frequency and cover since 1994. The dominate grass, Pinewoods needlegrass, decreased significantly in nested frequency. In 1994, it contributed 72% of the grass cover and decreased to only 5% by 2004. Slender wheatgrass and western wheatgrass both increased in percent cover. Sum of nested frequency for perennial forbs has decreased substantially. The Desirable Components Index rated this site as poor with a score of 40 due to large decrease in shrub cover, few young shrubs, and a decrease in grass cover.

TREND ASSESSMENT
soil - down slightly (2)
browse - down (1)
herbaceous understory - down (1)
winter range condition (DC Index) - 40 (poor) Mountain big sagebrush type

HERBACEOUS TRENDS --
Management unit 16C, Study no: 31

Type	Species	Nested Frequency				Average Cover %		
		'88	'94	'99	'04	'94	'99	'04
G	Agropyron smithii	a-	a-	a-	b63	-	-	1.36
G	Agropyron trachycaulum	b121	b128	a72	a39	1.15	.84	1.56
G	Festuca ovina	a26	a15	b110	a18	.10	2.92	.07
G	Poa fendleriana	a130	b157	b140	a79	2.85	2.59	2.28
G	Poa pratensis	-	-	-	3	-	-	.15
G	Sitanion hystrix	b27	a1	ab19	b28	.00	.13	.57
G	Stipa comata	-	-	-	3	-	-	.15
G	Stipa pinetorum	c236	d281	b208	a32	10.37	4.43	.31
Total for Annual Grasses		0	0	0	0	0	0	0
Total for Perennial Grasses		540	582	549	265	14.49	10.93	6.47
Total for Grasses		540	582	549	265	14.49	10.93	6.47
F	Antennaria parvifolia	5	16	18	1	.65	.84	.03
F	Androsace septentrionalis (a)	-	a-	b33	c66	-	.15	.36
F	Arabis spp.	b18	a-	a3	a4	-	.00	.01
F	Artemisia frigida	-	2	-	-	.00	-	-
F	Astragalus agrestis	ab8	ab16	b19	a1	.03	.17	.00
F	Astragalus convallarius	-	3	2	6	.01	.00	.09
F	Castilleja linariaefolia	b46	a3	a7	a-	.00	.10	-
F	Calochortus nuttallii	b20	a-	ab8	a3	-	.02	.00
F	Chaenactis douglasii	b21	a-	a1	a-	-	.00	-
F	Chenopodium spp. (a)	-	a-	a-	b186	-	-	2.72
F	Crepis acuminata	11	5	4	4	.01	.06	.06
F	Cryptantha spp.	-	2	-	-	.00	-	-
F	Descurainia pinnata (a)	-	-	-	2	-	-	.00
F	Eriogonum alatum	-	3	3	-	.00	.03	-
F	Erigeron eatonii	d197	c141	b67	a2	.54	.59	.00
F	Erigeron pumilus	a7	b22	a5	a-	.21	.04	-
F	Eriogonum racemosum	a72	a64	a70	b133	.25	.92	2.25
F	Eriogonum umbellatum	24	33	16	12	.15	.09	.23
F	Hymenoxys richardsonii	9	7	3	2	.02	.00	.15

Type	Species	Nested Frequency				Average Cover %		
		'88	'94	'99	'04	'94	'99	'04
F	Lappula occidentalis (a)	-	-	-	3	-	-	.00
F	Linum lewisii	-	-	-	1	-	-	.03
F	Lupinus argenteus	$_{ab}$3	$_{a}$-	$_{b}$9	$_{ab}$1	-	.08	.03
F	Lupinus spp.	$_{a}$-	$_{a}$-	$_{a}$-	$_{b}$15	-	-	.10
F	Machaeranthera canescens	9	-	-	-	-	-	-
F	Penstemon caespitosus	$_{b}$31	$_{a}$7	$_{a}$-	$_{a}$4	.04	-	.04
F	Penstemon carnosus	$_{a}$-	$_{ab}$1	$_{b}$10	$_{ab}$2	.00	.05	.18
F	Polygonum douglasii (a)	-	$_{a}$1	$_{a}$-	$_{b}$52	.00	-	.11
F	Senecio multilobatus	$_{a}$-	$_{a}$3	$_{a}$8	$_{b}$38	.00	.04	.86
F	Sphaeralcea coccinea	-	-	2	1	-	.00	.03
F	Taraxacum officinale	-	-	-	3	-	-	.03
F	Townsendia incana	1	-	-	-	-	-	-
F	Tragopogon dubius	$_{ab}$2	$_{a}$-	$_{ab}$6	$_{b}$11	-	.01	.11
Total for Annual Forbs		0	1	33	309	0.00	0.15	3.21
Total for Perennial Forbs		484	328	261	244	1.96	3.09	4.26
Total for Forbs		484	329	294	553	1.97	3.24	7.47

Values with different subscript letters are significantly different at alpha = 0.10

BROWSE TRENDS --
Management unit 16C, Study no: 31

Type	Species	Strip Frequency			Average Cover %		
		'94	'99	'04	'94	'99	'04
B	Artemisia frigida	3	4	5	.00	.01	.41
B	Artemisia nova	97	94	53	5.50	9.05	2.78
B	Artemisia tridentata vaseyana	22	29	3	1.80	1.95	.30
B	Ceratoides lanata	0	1	9	.03	.03	.15
B	Chrysothamnus depressus	3	6	2	.18	.16	-
B	Chrysothamnus viscidiflorus viscidiflorus	93	93	80	5.15	7.64	5.67
B	Gutierrezia sarothrae	8	8	0	.04	.09	-
B	Tetradymia canescens	6	9	11	.18	.24	.53
Total for Browse		232	244	163	12.90	19.17	9.86

CANOPY COVER, LINE INTERCEPT --
Management unit 16C, Study no: 31

Species	Percent Cover '04
Artemisia frigida	.50
Artemisia nova	3.53
Artemisia tridentata vaseyana	.23
Ceratoides lanata	.25
Chrysothamnus depressus	.40
Chrysothamnus viscidiflorus viscidiflorus	5.25
Tetradymia canescens	.36

KEY BROWSE ANNUAL LEADER GROWTH --
Management unit 16C, Study no: 31

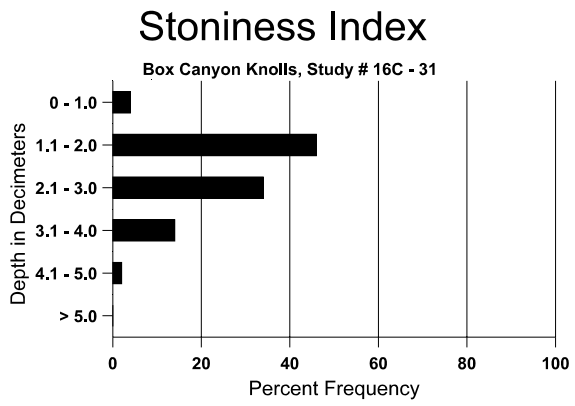
Species	Average leader growth (in) '04
Artemisia nova	2.3

BASIC COVER --
Management unit 16C, Study no: 31

Cover Type	Average Cover %			
	'88	'94	'99	'04
Vegetation	8.75	35.04	34.84	23.34
Rock	1.25	1.14	.76	.84
Pavement	.25	.70	1.35	.59
Litter	35.75	37.44	27.93	26.64
Cryptogams	.50	.23	.82	.75
Bare Ground	53.50	40.24	39.54	62.15

SOIL ANALYSIS DATA --
Management unit 16C, Study no: 31, Study Name: Box Canyon Knolls

Effective rooting depth (in)	Temp °F (depth)	pH	%sand	%silt	%clay	%0M	PPM P	PPM K	ds/m
13.8	49.3 (16.4)	6.8	42.0	25.4	32.6	2.9	13.2	137.6	0.4



PELLET GROUP DATA --
Management unit 16C, Study no: 31

Type	Quadrat Frequency		
	'94	'99	'04
Rabbit	16	7	3
Elk	62	55	40
Deer	11	5	4
Cattle	1	7	1

Days use per acre (ha)	
'99	'04
-	-
108 (267)	87 (215)
5 (12)	-
9 (22)	25 (61)

BROWSE CHARACTERISTICS --
Management unit 16C, Study no: 31

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Amelanchier utahensis												
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
94	**0**	-	-	-	-	-	0	0	-	-	0	16/20
99	**0**	-	-	-	-	-	0	0	-	-	0	14/36
04	**0**	-	-	-	-	-	0	0	-	-	0	16/38
Artemisia frigida												
88	**0**	-	-	-	-	-	0	0	0	-	0	-/-
94	**80**	-	-	80	-	-	0	0	0	-	0	2/5
99	**100**	-	40	60	-	-	60	0	0	-	0	6/6
04	**160**	80	-	140	20	-	13	13	13	-	0	15/17

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Artemisia nova												
88	**10332**	6133	3733	3066	3533	-	17	2	34	.19	9	8/13
94	**10260**	20	3800	5740	720	480	14	0	7	6	6	6/13
99	**12680**	1140	3980	6920	1780	1220	28	5	14	2	2	7/15
04	**3220**	740	20	2860	340	4320	15	0	11	4	4	8/13
Artemisia tridentata vaseyana												
88	**333**	-	200	-	133	-	40	0	40	-	0	-/-
94	**820**	-	80	720	20	20	0	0	2	2	2	11/18
99	**1060**	60	80	720	260	60	34	23	25	2	4	15/24
04	**140**	-	-	100	40	100	14	0	29	14	14	13/19
Ceratoides lanata												
88	**1266**	66	200	1000	66	-	0	0	5	-	0	6/6
94	**0**	-	-	-	-	-	0	0	0	-	0	5/7
99	**40**	-	-	40	-	-	100	0	0	-	0	4/5
04	**820**	560	560	260	-	-	15	73	0	-	0	4/9
Chrysothamnus depressus												
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
94	**100**	-	-	100	-	-	0	0	-	-	0	4/9
99	**160**	-	20	140	-	-	0	0	-	-	0	3/9
04	**40**	-	-	40	-	-	0	0	-	-	0	4/5
Chrysothamnus nauseosus												
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
94	**0**	-	-	-	-	-	0	0	-	-	0	21/24
99	**0**	-	-	-	-	-	0	0	-	-	0	18/24
04	**0**	-	-	-	-	-	0	0	-	-	0	-/-
Chrysothamnus viscidiflorus viscidiflorus												
88	**32599**	1200	7266	20800	4533	-	7	0	14	.06	4	3/6
94	**22420**	-	8080	14340	-	20	1	0	0	-	0	3/7
99	**19220**	80	2920	15520	780	140	3	0	4	.31	.41	4/8
04	**6300**	4740	140	6000	160	440	2	0	3	.31	.31	6/10
Gutierrezia sarothrae												
88	**0**	-	-	-	-	-	0	0	0	-	0	-/-
94	**220**	-	20	200	-	-	0	0	0	-	0	3/6
99	**460**	-	-	420	40	-	0	0	9	4	4	4/8
04	**0**	-	-	-	-	-	0	0	0	-	0	-/-

		Age class distribution (plants per acre)					Utilization					
Year	Plants per Acre (excluding seedlings)	Seedling	Young	Mature	Decadent	Dead	% moderate	% heavy	% decadent	% dying	% poor vigor	Average Height Crown (in)
Opuntia polyacantha												
88	**133**	-	-	133	-	-	0	0	-	-	0	2/6
94	**0**	-	-	-	-	-	0	0	-	-	0	-/-
99	**0**	20	-	-	-	-	0	0	-	-	0	3/15
04	**0**	-	-	-	-	-	0	0	-	-	0	5/10
Tetradymia canescens												
88	**0**	-	-	-	-	-	0	0	-	-	0	-/-
94	**160**	-	20	140	-	-	13	0	-	-	0	6/8
99	**240**	-	-	240	-	-	42	25	-	-	0	6/8
04	**300**	-	-	300	-	-	0	20	-	-	0	9/13